

REMARKS

Claim 1 is amended by reciting the limitation that the upwardly inclined surface maintains continuous contact substantially entirely around the peripheral edge, to better describe the invention. Support for this amendment can be found in the specification and drawings, for example, in the paragraph starting on page 6, lines 8 to 17, which describes line contact with the wafer carrier around the entire periphery edge of the wafer to seal the backside of the wafer from deposition gases. Claims 1-4, 6, 8, 10 and 11 are pending in this application.

Claims 1, 3, 4, 6, 8, 10 and 11 are rejected under 35 U.S.C. 103(a) as unpatentable over U.S. Patent No. 5, 242, 501 (McDiarmid) in view of U.S. Patent Nos. 5,242,501 (Inoue) and 3,151,006 (Grabmaier). Claims 1-4, 6, 8, 10 and 11 are rejected under 35 U.S.C. 103(a) as unpatentable over U.S. Patent No. 5,891,251 (MacLeish) in view of Inoue and Grabmaier. Applicant respectfully traverses these rejections and submits that the claims of this application are patentable over the cited art.

When rejecting claims under 35 U.S.C. §103, the Examiner bears the burden of establishing a prima facie case of obviousness. See, e.g., *In re Bell*, 26 USPQ2d 1529 (Fed. Cir. 1993); M.P.E.P. §2142. To establish a prima facie case, three basic criteria must be met: (1) the prior art must provide one of ordinary skill with a suggestion or motivation to modify or combine the teachings of the references relied upon by the Examiner to arrive at the claimed invention; (2) the prior art must provide one of ordinary skill with a reasonable expectation of success; and (3) the prior art, either alone or in combination, must teach or suggest each and every limitation of the rejected claims. The teaching or suggestion to make the claimed invention, as well as the reasonable expectation of success, must come from the prior art, not Applicant's disclosure. In *re Vaack*, 20 USPQ2d 1438 (Fed. Cir. 1991); M.P.E.P. §706.02(j). If any one of these criteria is not met, prima facie obviousness is not established.

The two primary references cited by the Examiner, McDiarmid and MacLeish, do not teach or suggest each and every element of the claimed invention. McDiarmid and MacLeish teach a susceptor made substantially of graphite. As correctly pointed out by the Examiner, McDiarmid and MacLeish do not teach that the wafer carrier is made of a material selected from

the group consisting of silicon carbide, aluminum nitride, large-grained polycrystalline silicon and silicon/silicon carbide alloy; that the edge region has a width of 5 to 25 mm; that the upwardly inclined surface is inclined at an angle of 5 to 45 degree, especially 10 degree; that the recess is 200 or 300 mm (to fit a 200 or 300 mm substrate); and that the space between the back of the substrate and the bottom surface of the carrier is between 0.15 to 0.5 mm, specially, 0.25 mm.

However, the Examiner states in the Office Action that Inoue teaches a member made of aluminum nitride; that Grabmaier teaches a carrier rod made of a highly pure silicon rod; that it would be obvious to combine aluminum nitride or silicon rod taught by Inoue or Grabmaier with the shape of the susceptor of McDiarmid or MacLeish to arrive at the present invention. Applicant respectfully disagrees.

The courts have long held emphatically that before the Patent Office combines the disclosures of two or more prior art references in order to establish a prima facie obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 351 (Fed. Cir. 1992). The Examiner does not provide any evidence that shows that there is an explicit or implicit teaching or suggestion in any of the cited references to combine MacLeish or McDiarmid with Inoue and Grabmaier, to arrive at the claimed invention.

McDiarmid teaches a susceptor made of graphite with a cavity to prevent a wafer supported therein from warping during processing, thereby reducing or eliminating dislocations in the epitaxially grown layer and the wafer. The problem that McDiarmid seeks to solve is more clearly illustrated in its FIG. 6, which shows a bow-shaped wafer caused by the entire surface contact with the susceptor. MacLeish teaches a CVD reactor including a wafer susceptor made of graphite. As shown in FIGS. 3A-3B of MacLeish, the susceptor is recessed such that a minimum number of points along the outer edge of the wafer is in intimate contact with the susceptor, thereby minimizing conductive transfer between the susceptor and wafer. Neither McDiarmid nor MacLeish teach or suggest the material recited in claim 1 of the invention used for making the wafer carrier. Neither McDiarmid nor MacLeish teach or suggest a wafer carrier

that maintains *a line contact continuously with only periphery edge of the wafer* in order to reduce wafer backside damage and contamination caused by entire surface contact with the wafer carrier, and to prevent deposition on the backside of the wafer during deposition on the front side of the wafer. In fact, neither McDiarmid nor MacLeish even describe the problems of wafer backside damages and contaminations caused by the surface contact with the susceptor, and the backseal applications that are made possible by the continuous line contact with the entire periphery edge of the wafer as in the present invention.

Inoue describes a round, flat wafer holder made of blackened aluminum nitride. The motivation of Inoue is to increase the absorption of light of wavelength emitted by halogen lamps in order to increase the heat transfer to the wafer. The wafer carrier of Inoue contacts the entire backside of the wafer, which appears to be required for uniform heating of the wafer. There is no teaching or suggestion in either McDiarmid and MacLeish or Inoue to combine the blackened aluminum nitride with the shape of the susceptor of McDiarmid or MacLeish to provide a wafer carrier with reduced wafer contamination and damages, and backseal applications. To the contrary, the blackened aluminum nitride of Inoue is to increase the absorption of light of wavelength emitted by halogen lamps in order to increase the heat transfer to the wafer, while the graphite of McDiarmid and MacLeish is used as a conductor to couple RF heating to the wafer. *These conflicting functions of the susceptor materials prohibit one of ordinary skill from combining Inoue with McDiarmid or MacLeish.*

Grabmaier describes a highly pure semiconductor carrier material which is the same material as the semiconductor being processed in order to minimize impurities in the making of precipitated single crystalline semiconductor layers. However, no where does Grabmaier teach or suggest that the highly pure silicon material can be used in making a wafer carrier where a substrate is supported by the wafer carrier around only and continuously the peripheral edge of the substrate and the rest of the backside of the substrate does not contact the recessed bottom surface. The Examiner does not provide any evidence showing that there is teaching or suggestion in any of the cited references to combine Grabmaier's material with the shape of the susceptor of McDiarmid or MacLeish.

In *Ex Parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Inter. 1985), the Board of Appeal held that to support the conclusion that the claimed combination is directed to obvious subject matter, *either the references must either expressly or impliedly suggest the claimed combination, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.* The Examiner does not present a convincing line of reasoning as to why one of ordinary skill would have found the claimed wafer carrier to have been obvious in light of the cited references. The Examiner states only, over-generally, that the motivation is to provide an alternate and equivalent material of construction; or an alternate and superior material of construction that is more stable and chemically inert to the reaction gases. However, the Examiner does not present a convincing line of reasoning why one of ordinary skill would have found it obvious to selectively pick or choose the *shape* of the susceptor of McDiarmid or MacLeish and the *materials* of Inoue or Grabmaier to arrive at the wafer carrier of the present invention. Presuming arguendo that the cited references independently teach the shape of susceptor and the materials, one of ordinary skill would not have found it obvious to selectively pick and choose McDiarmid or MacLeish and Inoue or Grabmaier so as to arrive at the wafer carrier of the present invention without using the claims as a guide. Indeed, one of ordinary skill has to be guided by the claims of present invention with respect to the thermal expansion and thermal conductivity of the materials, and the size and dimension of the carrier design in order to produce the wafer carrier of the invention that provides continuous line contact with only the periphery edge of the wafer during the processing without producing adverse effects such as wafer backside damages and contamination and deposition on the wafer backside.

Obviousness is tested by what the combined teachings of the references would have *suggested* to those of ordinary skill in the art. In *re Fine* 837 F.2d 1071, 1075 (Fed. Cir. 1988). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. *Id.* The teachings of references can be combined *only* if there is some suggestion or incentive to do so. *Id.* Here, none of the prior art references cited by the Examiner contain any suggestion or

incentives supporting the combination. Nor does the Examiner present a convincing line of reasoning why one of ordinary skill would have found it obvious to combine the references.

Applicant respectfully submits that the Examiner relies on hindsight in reaching the obviousness determination which has been long prohibited by the court. Simplicity and hindsight are not the criteria for resolving the issue of obviousness. *Ex Parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Inter. 1985). One cannot use hindsight reconstruction to pick and choose among *isolated* disclosures in the prior art to deprecate the claimed invention. *In re Fine* 837 F.2d 1071, 1075 (Fed. Cir. 1988).

Further, the mere fact that the materials of Inoue, or Grabmaier can be combined, *arguendo*, with the shape of the susceptor of McDiarmid or MacLeish does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990). The court held that although a prior art device may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion in the reference to do so. *Id.* at 682. There is no evidence showing the suggestion or the desirability in any of the cited references to combine the materials of Inoue or Grabmaier with the shape of the susceptor of McDiarmid or MacLeish, to provide a wafer carrier that can prevent wafer backside damages and contamination and deposition on the wafer backside. In fact, the material of the susceptors in McDiarmid and MacLeish are selected to perform a function, i.e., to conduct RF energy. Applicant contends that to substitute a different material would defeat the desirability of the specific materials of Inoue or Grabmaier. Thus, the cited references teach away from such combination.

Even a combination would have been attempted *arguendo* by one of ordinary skill, such combination cannot arrive at the wafer carrier of the present invention for the following reasons.

Neither McDiarmid nor MacLeish teach a wafer carrier that supports a wafer around only and continuously the periphery edge of the wafer. To the contrary, MacLeish teaches that a *minimum number of points* along the outer edge of wafer rest on the susceptor. Applicant respectfully submits that "a minimum number of point" taught by MacLeish does not meet the limitation of "continuous" as recited in Applicant's amended claims. Nor does McDiarmid specify a complete edge contact with the wafer susceptor. This is not surprising because neither

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MacLeish nor McDiarmid contemplates the problem of deposition on the backside of a wafer during the deposition on the front side of the wafer, one of which the present invention is designed to solve. The motivation of maintaining minimum point contact in MacLeish is to minimize conductive heat transfer between the susceptor and wafer. Any combination with MacLeish or McDiarmid can only arrive at a wafer carrier which has point contact (in contrast to entire continuous contact) with the periphery edge of the wafer supported thereon.

Applicant emphasizes that the selection of one material over another is not a simple, or obvious matter. The wafer susceptor of McDiarmid and MacLeish are comprised substantially of graphite for an important reason - graphite acts as a conductor to couple RF heating to the wafer carrier. However, the graphite susceptors of the prior art are not suited for the wafer carrier of the present invention, because the CVD processing environment employed in the present invention would readily oxidize a graphite susceptor. Graphite has anisotropic thermal properties which result in unpredictable thermal effects, particularly thermal expansion which is orientation dependent and difficult to control, and is thus not suitable for supporting a wafer around its entire periphery edge as recited in Applicant's claims. In the present invention, the material for the wafer carrier is selected based on a variety of factors including its thermal expansion and thermal conductivity, so that the wafer carrier not only promotes heat transfer to the wafer, but also maintain linear continuous contact with the periphery edge of the wafer to provide backseal applications.

Moreover, Applicant respectfully submits that the designs of size for the wafer carrier are not simple and obvious matter. The combination of the width of the flat region of about 5 to 25 mm, the incline angle of 5 to 45 degree, and the space of 0.15 to 0.5 mm between the back of the substrate and carrier bottom surface, provides a desired effect of continuous contact with the periphery edge of the wafer, while maintaining good edge effect and thermal conductivity. As the prior art does not teach or suggest the desirability of maintaining continuous contact throughout processing, one would not be motivated by the prior art to arrive at these specific dimension limitations.

In view of the foregoing, Applicant respectfully submits that a prima facie obviousness has not been established. Withdrawal of the rejections under 35 U.S.C. 103 is respectfully requested.

If any matters can be handled by telephone, Applicant requests that the Examiner telephone Applicants' attorney at the number below. The Commissioner is authorized to charge any additional fees to Deposit Account No. 50-2319 (Order No. A-64873-1/MSS (463035-350)).

Respectfully submitted,



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